CLAIMS

1. Method for establishing a preferred operating point for a preselected powertrain operating parameter in a powertrain system, comprising:

determining a feasible operating space for the preselected powertrain operating parameter;

searching the feasible operating space for a value corresponding to a minimum system power loss; and,

establishing the preferred operating point as the value corresponding to the minimum system power loss.

2. The method for establishing a preferred operating point for a preselected powertrain operating parameter as claimed in claim 1 wherein said preselected powertrain parameter comprises an input torque.

3. The method for establishing a preferred operating point for a preselected powertrain operating parameter as claimed in claim 1 wherein said powertrain system includes an internal combustion engine, a transmission, an electric machine and an energy storage device.

4. The method for establishing a preferred operating point for a preselected powertrain operating parameter as claimed in claim 3 wherein said substantially minimum system power loss is further determined by factoring in a subjective power loss not related to an actual sub-system power loss but effective to a bias said substantially minimum power loss toward values of the preselected powertrain operating parameter which require less energy storage system use.

5. The method for establishing a preferred operating point for a preselected powertrain operating parameter as claimed in claim 1 wherein said preferred operating point is periodically updated in accordance with the

method of claim 1, and further wherein such periodic update proceeds during quiescent powertrain operation only when the value for the most recent search corresponds to a respective minimum power loss that is at least a predetermined amount less than the respective minimum power loss corresponding to the previously established preferred operating point.

6. The method for establishing a preferred operating point for a preselected powertrain operating parameter as claimed in claim 1 wherein minimum system power loss is determined from a plurality of sub-system power losses.

7. The method for establishing a preferred operating point for a preselected powertrain operating parameter as claimed in claim 1 wherein searching the feasible operating space for a value comprises performing a section search.

8. The method for establishing a preferred operating point for a preselected powertrain operating parameter as claimed in claim 7 wherein said section search comprises a golden section ratio.

9. Method for determining a preferred input torque for efficiently operating an electrically variable transmission including an input, an output and an electric machine having known coupling relationships, and an energy storage system, comprising:

determining current EVT operating conditions including input, output and electric machine speeds;

determining system constraints in electric machine torque, battery power and input torque at current EVT operating conditions;

providing a target output torque producible within said system constraints;

calculating aggregate power losses corresponding to feasible input torques that can produce the target output torque within said system constraints;

converging upon a feasible input torque corresponding to a substantially minimum aggregate power loss; and,

selecting as the preferred input torque the feasible input torque corresponding to the substantially minimum aggregate power loss.

10. The method for determining a preferred input torque as claimed in claim 9 wherein calculating aggregate power losses comprises:

calculating individual sub-system power losses; and,

summing the individual sub-system power losses.

11. The method for determining a preferred input torque as claimed in claim 10 wherein individual sub-system power losses are selected from the group consisting of an input source power loss, an electric machine power loss, an energy storage system power loss, and an accessory power loss.

12. The method for determining a preferred input torque as claimed in claim 9 wherein calculating aggregate power losses includes biasing power losses higher as a predetermined function of energy storage system use.

13. The method for determining a preferred input torque as claimed in claim 9 wherein said preferred input torque is periodically updated in accordance with the method of claim 9, and further wherein such periodic update proceeds during quiescent powertrain operation only when the most recently selected feasible input torque corresponds to a respective substantially minimum aggregate power loss that is at least a predetermined amount less than the respective substantially minimum aggregate power loss corresponding to the previously selected feasible input torque.

14. The method for determining a preferred input torque as claimed in claim 9 wherein converging upon a feasible input torque comprises performing a section search in feasible input torques and corresponding aggregate power losses.

15. The method for determining a preferred input torque as claimed in claim 14 wherein said section search comprises a golden section ratio.

16. The method for determining a preferred input torque as claimed in claim 9 wherein converging upon a feasible input torque comprises performing an iterative derivative convergence.

17. The method for determining a preferred input torque as claimed in claim 9 wherein converging upon a feasible input torque comprises performing polynomial estimations.

18. A hybrid powertrain system comprising:

an engine;

an electric machine;

an energy storage system;

an output;

wherein the energy storage system and electric machine are electrically-operatively coupled for power flow therebetween, and wherein the engine, electric machine and output are mechanically-operatively coupled for power flow therebetween; and

a computer based controller including a storage medium having a computer program encoded therein for determining an engine torque at predetermined engine speed and output speed conditions that result in a substantially minimum powertrain power loss, said computer program including

code for determining a feasible operating space for engine torque; and,

code for searching the feasible operating space for a value of engine torque corresponding to a substantially minimum powertrain system power loss.

19. The hybrid powertrain as claimed in claim 18 wherein the code for determining a feasible operating space for engine torque comprises:

code for determining current powertrain system operating conditions including engine, output and electric machine speeds; and,

code for determining powertrain system constraints in electric machine torque, energy storage system power and engine torque at current powertrain system operating conditions.

20. The hybrid powertrain as claimed in claim 19 wherein the code for searching the feasible operating space for a value of engine torque corresponding to a substantially minimum powertrain system power loss comprises:

code for providing a target output torque producible within said powertrain system constraints;

code for calculating aggregate powertrain system power losses corresponding to engine torques that can produce the target output torque within said powertrain system constraints;

code for converging upon an engine torque corresponding to a substantially minimum calculated aggregate powertrain system power loss; and,

code for selecting as the value of engine torque corresponding to a substantially minimum powertrain system power loss the engine torque corresponding to the substantially minimum calculated aggregate powertrain system power loss.